COURSE DATA

DATA SUBJECT

Code: 33101
Name: Mathematics II
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1104 - Degree in Environmental Sciences	Facultat de Ciències Biològiques	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1104 - Degree in Environmental Sciences	Mathematics II	BASIC

COORDINATION

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SUMMARY

The subject Mathematics II is conceived as a fundamental course for the education of any experimental scientist. Its aim is to equip students with the necessary tools and basic concepts of Statistics to formulate statistical hypotheses, recognize simple probabilistic models, statistically analyze data obtained directly from nature or as a result of laboratory experiments, and make informed decisions based on the conclusions drawn from such analysis. Students will develop skills in collecting, organizing, analyzing, and interpreting environmental data using computer tools and statistical software, with the ultimate goal of effectively applying statistical principles in the study and comprehension of environmental phenomena.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

No registration restrictions have been specified with other subjects in the curriculum.

Prerequisites or recommendations:
- Ability to interpret practical statements using mathematical language.
- Competence in the use of technological tools and mathematical software.
- Knowledge of the basic concepts of Probability corresponding to Mathematics I in the first year of high school.

COMPETENCES / LEARNING OUTCOMES

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Capacidad de describir y analizar el conjunto de datos obtenidos en el experimento utilizando software adecuado.

Capacidad de planificar experimentos sencillos útiles para alcanzar objetivos del estudio.

Saber elaborar y presentar un informe del estudio realizado.

Saber interpretar los resultados proporcionados por el software utilizado.

DESCRIPTION OF CONTENTS

1. Exploratory Data Analysis

1.1. Populations and samples.
1.2. Types of variables and their relationships.
1.3. Graphical description of variables and analysis of their relationships.
1.4. Numerical descriptive statistics.

2. Probability

2.1. Probability of events.
2.2. Probability: Discrete distributions.
2.3. Probability: Continuous distributions.

3. Statistical analysis of a sample

3.1. Population parameters.
3.2. Estimation of the population mean.
3.3. Hypothesis testing for the mean.

3.4. Assumptions for the validity of the t-Student test.
3.5. Non-parametric alternative: Wilcoxon test.

4. Analysis analysis of two samples

4.1. Related samples.
4.1.1. Experimental design with related observations.
4.1.2. t-test and confidence interval.
4.1.3. Wilcoxon signed-rank test.

4.2. Independent samples.
4.2.1. Design of experiments with independent observations.
4.2.2. t-test and confidence interval.
4.2.3. Mann-Whitney U test.

5. Analysis analysis of k independent samples.

5.1. Design of experiments with k independent samples.
5.2. Analysis of variance and post hoc comparisons.
5.3. Kruskal-Wallis test.

6. Analysis of categorical data

6.1. Analysis of proportions.
6.2. Goodness-of-fit test.
6.3. Analysis of contingency tables.

7. Linear regression

7.1. Parametric interpretation of regression: the linear model.
7.2. Statistical inference about the slope.
7.3. Coefficient of correlation.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	33,00
Computer classroom practice	27,00

Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	50,00
Preparation of lessons	20,00
Preparation for assessment activities	20,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The teaching methodology in the theory classes will be of a master class type. The different statistical elements and procedures will be introduced through real examples, following a basic conceptual and applied presentation. Conceptual, because the aim is to understand the basic methodology of statistical inference without the mathematical elements that could complicate its learning. Applied, because the aim is to link statistical procedures to a real context of application.

The practical sessions, in which the students are the protagonists, are designed to be synchronised with the theory and take place in computer laboratories. In these sessions, students will apply and discuss the theoretical procedures presented in the theory classes through problem solving and analysis of "adapted" databases illustrating real applications in the context of environmental sciences.

Students will have access to basic materials available in the virtual classroom: a detailed presentation of each of the topics explained in the theory classes, a guide for each of the practical sessions to help consolidate, reinforce and apply the methods of statistical analysis introduced in the theory sessions, and a collection of problems designed to enhance and consolidate both theoretical and practical learning.

The tutorials will be used to discuss and consolidate the concepts studied so far.

Attendance at the various academic activities is not compulsory, although attendance at the practical sessions in the computer lab can count for up to 5% of the final mark (see Evaluation section). However, attendance and active participation in theory and practical classes is strongly recommended.

EVALUATION

The evaluation of learning will be carried ouy by means of the following activities:

1. A theoretical-practical exam involving the solution of problems, questions and the interpretation of various results presented in the standard format of the statistical software used during the course (up to 8.0 marks; 80% of the final mark). The minimum mark required for this activity in order to be able to average the overall mark must be at least 4.5 out of 10.

2. Attendance and participation in practical sessions in the computer lab (up to 0.5 points; 5% of the final mark).

3. Presentation of a final report on the results of the practical sessions (up to 1 point; 10% of the final mark).

4. Practical exam (up to 0.5 points; 5% of final mark).

To pass the cours, a totat mark of at least 5 points is required.

The continuous assessment, corresponding to activities 2, 3 and 4, is not recuperable and will only be retained in the two official examinations corresponding to the academic year in question.

In any case, the evaluation system will be in accordance with what is established in the Reglamento de Evaluación y Calificación de la Universitat de València para Grados y Másters available at:

http://www.uv.es/graus/normatives/2017_108_Reglament_avaluacio_qualificacio.pdf

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA (ACGUV 123/2020).

REFERENCES

- P.M. Berthouex and L.C. Brown. Environmental Engineers. Lewis Publishers, second edition, 2002.
- J. Verzani. Using R for Introductory Statistics. Chapman & Hall / CRC, 2005.
- P. Dalgaard. Introductory Statistics with R. Springer, 2002.
- M.L. Samuels and J.A. Witmer. Statistics for the Life Sciences. Pearson Education, 2003.
- W. Chase and F. Bown. General Statistics. Wiley and Sons, 1992.
- Walter W. Piegorsch and A. John Bailer. Analyzing Environmental Data. Wiley, 2005.
- Clemens Reimann, Peter Filzmoser, Robert Garret, and Rudolf Dutter. Statistical Data Analysis Explained. Applied Environmental Statistics with R. Wiley, Chichester, UK, 2008.